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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary**Application No.**

09/911,764

Applicant(s)

PAPATHANASIOU, APOSTOLIS

Examiner

Chat C. Do

Art Unit

2193

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06/17/2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20-34 and 36-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20-34 and 36-53 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/C2)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This communication is responsive to Amendment filed 06/17/2009.
2. Claims 20-34 and 36-53 are pending in this application. Claims 20 and 37 are independent claims. This Office Action is made final.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 20-34 and 36-53 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Re claim 20, the newly added limitations "DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals, wherein during said adaptive filtering, the DSP enables:" was not sufficiently described in the specification in such a detail way as to enable one skilled in the art to make and/or use the invention. The original specification merely mentions the term DSP in page 3 but does not fully address the above limitation.

Re claim 37, the newly added limitation "at least one DSP that apply LESS..." was not described in the specification in such a detail way as to enable one skilled in the art to make and/or use the invention. Claims 48-53 have the similar rejection.

Thus, claims 21-34, 36-38 and 39-53 are also rejected for being dependent on the rejected base claims 21 and 37 respectively.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 20, 23-34, 36-37 and 40-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. ("Unitary ESPRIT: How to Obtain Increased Estimation Accuracy with a Reduced Computational Burden") in view of the admitted prior art.

Re claim 20, Martin et al. disclose in the article a system for processing signals (e.g. abstract in page 1232 and conclusion remark in page 1241 by filtering/reconstructing the original waveform/signal), the system comprising: transforming adaptation observations from a complex arithmetic to two corresponding sets of real number arithmetic observations by means of binary orthogonalization transformation (BOT) (e.g. page 1232 right column lines 3-17 which transforming/converting the complex matrices into a set of real matrices); computing two corresponding sets of real number arithmetic adaptation parameters by applying a

solution algorithm to said two corresponding sets of real number arithmetic observations (e.g. section B as real implementation in page 1236 wherein least square solution can be applied here); and transforming said two sets of real adaptation parameters to a set of complex number arithmetic adaptation parameters using an inverse binary orthogonalization transform (IBOT) (e.g. as reversed processed of BOT above, page 1232 right column lines of first paragraph, and right column lines 8-10 page 1232), and utilizing at least a portion of single set of complex arithmetic adaptation parameters for the adaptive filtering of the adaptation observations (e.g. abstract in page 1232 and conclusion section in page 1241 for filtering/reconstructing the original waveform/signal using the above technique).

Martin et al. fail to disclose (1) a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals and (2) explicitly spell-out the term LESS as a means for computing two sets of real number arithmetic adaptation parameters by applying two real number Least Square Solvers (LESS) to said two sets of real number arithmetic observations. However, the admitted prior art discloses in page 1 a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals (e.g. page 1 second paragraph) and a means for computing two sets of real number arithmetic adaptation parameters by applying two real number Least Square Solvers (LESS) to said two sets of real number arithmetic observations (e.g. last two paragraphs in page 1 wherein LESS is common and most widely used in solving such systems of linear equations).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals and a means for computing two sets of real number arithmetic adaptation parameters by applying two real number Least Square Solvers (LESS) to said two sets of real number arithmetic observations as taught in the admitted prior art to Martin et al.'s invention because it would enable to solve unknowns in linear equations efficiently (e.g. as common and widely used in many practical application in page 1 of the original application).

Re claims 23-24, Martin fails to disclose the LESS comprises a Recursive Least Squares algorithm (RLS) and a Least Mean Squares (LMS) algorithm. However, the admitted prior art discloses the LESS comprises RLS and LMS (e.g. last two paragraphs in page 1 of original specification).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the LESS comprises RLS and LMS as taught in the admitted prior art to Martin et al.'s invention because it would enable to solve unknowns in linear equations efficiently (e.g. as common and widely used in many practical application in page 1 of the original application).

Re claims 25-27, Martin et al. fail to disclose LESS is a Householder transformation; Cholesky decomposition; and QR Decomposition (QRD). However, the admitted prior art discloses the LESS is a Householder transformation (e.g. last paragraph in page 4); Cholesky decomposition (e.g. last paragraph in page 4); and QR Decomposition (QRD) (e.g. last two paragraphs in page 1).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the LESS is a Householder transformation; Cholesky decomposition; and QR Decomposition (QRD) as taught in the admitted prior art to Martin et al.'s invention because it would enable to solve unknowns in linear equations efficiently (e.g. as common and widely used in many practical application in page 1 of the original application).

Re claim 28, Martin et al. fail to disclose the RLS is computed by a systolic array. However, the admitted prior art discloses the RLS is computed by a systolic array (e.g. page paragraph in page 4).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the RLS is computed by a systolic array as taught in the admitted prior art to Martin et al.'s invention because it would enable to improve the system performance (e.g. by implementing the systolic array).

Re claims 29-30, Martin et al. fail to disclose the LESS utilizes one or more a Block Matched Filter Estimator (BMFE), a Block Zero Forcing Estimator (BZFE), and/or a Block Minimum Mean Square Error Estimator (BMMSEE) and computed via one or both a Cholesky decomposition and a QR Decomposition (QRD). However, the admitted prior art discloses in Figure 1 the LESS utilizes one or more a Block Matched Filter Estimator (BMFE), a Block Zero Forcing Estimator (BZFE), and/or a Block Minimum Mean Square Error Estimator (BMMSEE) (e.g. last four lines of last paragraph in page 4) and computed via one or both a Cholesky decomposition and a QR Decomposition (QRD) (e.g. last paragraph in page 4).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the LESS utilizes one or more a Block Matched Filter Estimator (BMFE), a Block Zero Forcing Estimator (BZFE), and/or a Block Minimum Mean Square Error Estimator (BMMSEE) and computed via one or both a Cholesky decomposition and a QR Decomposition (QRD) as taught in the admitted prior art to Martin et al.'s invention because it would enable to solve unknowns in linear equations efficiently (e.g. as common and widely used in many practical application in page 1 of the original application).

Re claim 31, it has similar limitations cited in claim 20. Thus, claim 31 is also rejected under the same rationale as cited in the rejection of rejected claim 20.

Re claims 32-34 and 36, Martin et al. do not disclose linear system performing one or more of temporal, spatial, joint temporal, and/or spatial channel estimation of the signal; spatial channel equalization, carrier frequency estimation, Direction of Arrival (DOA) estimation, and joint carrier frequency and DOA estimation, an adaptive filter, and channel estimation, system parameter estimation, channel equalization, recursive updating of output parameters, non-recursive updating of output parameters, and system identification. However, the admitted prior art discloses in Figure 1 linear system performing one or more of temporal, spatial, joint temporal, and/or spatial channel estimation of the signal; spatial channel equalization, carrier frequency estimation, Direction of Arrival (DOA) estimation, and joint carrier frequency and DOA estimation, an adaptive filter, and channel estimation, system parameter estimation, channel equalization, recursive updating of output parameters, non-recursive updating of output

parameters, and system identification (e.g. page 1 and page 4 as under background of invention and admitted prior art Figure 1).

Therefore, it would have been obvious applications to a person having ordinary skill in the art at the time the invention is made to apply the linear system performing one or more of temporal, spatial, joint temporal, and/or spatial channel estimation of the signal; spatial channel equalization, carrier frequency estimation, Direction of Arrival (DOA) estimation, and joint carrier frequency and DOA estimation, an adaptive filter, and channel estimation, system parameter estimation, channel equalization, recursive updating of output parameters, non-recursive updating of output parameters, and system identification as taught in the admitted prior art to Martin et al.'s invention because it would enable to reduce the complexity of computing the estimated signals.

Re claim 37, it is a system claim having similar limitations cited in claim 20. Thus, claim 37 is also rejected under the same rationale as cited in the rejection of rejected claim 20.

Re claim 40, it is a system claim having similar limitations cited in claim 23. Thus, claim 40 is also rejected under the same rationale as cited in the rejection of rejected claim 23.

Re claim 41, it is a system claim having similar limitations cited in claim 24. Thus, claim 41 is also rejected under the same rationale as cited in the rejection of rejected claim 24.

Re claim 42, it is a system claim having similar limitations cited in claim 25. Thus, claim 42 is also rejected under the same rationale as cited in the rejection of rejected claim 25.

Re claim 43, it is a system claim having similar limitations cited in claim 26. Thus, claim 43 is also rejected under the same rationale as cited in the rejection of rejected claim 26.

Re claim 44, it is a system claim having similar limitations cited in claim 27. Thus, claim 44 is also rejected under the same rationale as cited in the rejection of rejected claim 27.

Re claim 45, it is a system claim having similar limitations cited in claim 28. Thus, claim 45 is also rejected under the same rationale as cited in the rejection of rejected claim 28.

Re claim 46, it is a system claim having similar limitations cited in claim 29. Thus, claim 46 is also rejected under the same rationale as cited in the rejection of rejected claim 29.

Re claim 47, it is a system claim having similar limitations cited in claim 30. Thus, claim 47 is also rejected under the same rationale as cited in the rejection of rejected claim 30.

Re claim 48, it is a system claim having similar limitations cited in claim 31. Thus, claim 48 is also rejected under the same rationale as cited in the rejection of rejected claim 31.

Re claim 49, it is a system claim having similar limitations cited in claim 32. Thus, claim 49 is also rejected under the same rationale as cited in the rejection of rejected claim 32.

Re claim 50, it is a system claim having similar limitations cited in claim 33. Thus, claim 50 is also rejected under the same rationale as cited in the rejection of rejected claim 33.

Re claim 51, it is a system claim having similar limitations cited in claim 34. Thus, claim 51 is also rejected under the same rationale as cited in the rejection of rejected claim 34.

Re claim 52, it is a system claim having similar limitations cited in claim 35. Thus, claim 52 is also rejected under the same rationale as cited in the rejection of rejected claim 35.

Re claim 53, it is a system claim having similar limitations cited in claim 36. Thus, claim 53 is also rejected under the same rationale as cited in the rejection of rejected claim 36.

7. Claims 21-22 and 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. ("Unitary ESPRIT: How to Obtain Increased Estimation Accuracy with a Reduced Computational Burden") in view of the admitted prior art, as applied to the base claims 20 and 37, and further in view of Camp et al. (U.S. 5,592,517).

Re claims 21-22, Martin et al. fail to disclose two real number LESS are applied in parallel and series. However, the admitted prior art discloses in Figure 1 the LESS are

applied in either series or parallel manner (e.g. component 100 in Figure 1) and further Camp et al. disclose in Figures 1-7 a filtering method having component structures in either series or parallel manner (e.g. claims 7 and 10 respectively).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to apply the LESS in parallel and series manner as conceptually manner computation of Camp et al. and the admitted prior art's invention into Martin's invention because it would enable to improve the system performance (e.g. parallel manner would increase the speed operation and series manner would increase the dependency).

Re claim 38, it is a system claim having similar limitations cited in claim 21. Thus, claim 38 is also rejected under the same rationale as cited in the rejection of rejected claim 21.

Re claim 39, it is a system claim having similar limitations cited in claim 22. Thus, claim 39 is also rejected under the same rationale as cited in the rejection of rejected claim 22.

Response to Amendment

8. The amendment filed 01/09/2009 and 06/17/2009 are objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

The newly added limitations in the amended claims "DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals, wherein during said adaptive filtering, the DSP enables:" and "at least one DSP that applies LESS to transform..." are considered new matter introduced into the disclosure. Applicant is required to cancel the new matter in the reply to this Office Action.

Response to Arguments

9. Applicant's arguments filed 06/17/2009 have been fully considered but they are not persuasive.

a. The applicant argues in pages 13-14 for claims rejected under 35 U.S.C. 112 1st paragraph that the rejection is overcome by the current amended claims, the summary of the invention mentioned the adaptive filtering; and further that an "adaptive filter" to communication signal is implemented by a programmable DSP which is disclosed in Figures 2-6 of the present application.

The examiner respectfully submits that the current amendment does not cure the issue with the previous rejection under 35 U.S.C. 112 1st paragraph since the amendment just worded the same subject matter differently. The applicant does not provide any concrete citation within the specification to support the enable/written description of the newly added subject matters. In another word, the examiner cannot find, within the specification, a clear support of a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signal as cited in claim 20 and at least one DSP that applies LESS for

transformation as cited in claim 37. At most, the specification mentions briefly “a DSP” as applying LESS on a programmable machine like a DSP but silences a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signal as cited in claim 20 and at least one DSP that applies LESS for transformation as cited in claim 37. Figures 2-6 and page 3 of specification of the present application are merely the building block of xBOT structure, they neither disclose an at least DSP that applies LESS or a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals as responded by the applicant. The examiner respectfully requests the applicant clearly and specifically point out, within the original specification, the support the above limitations.

- b. The applicant responses to the examiner’s arguments in pages 15-18 for claims that the support for new matter is seen in page 3 of the specification; the AAPA does not disclose using a DSP which is a hardware device to perform the adaptive signal processing and finally Martin only discloses effectively enlarges the real number matrix to twice its size and not generating two real number matrices as required by the claims.

The examiner respectfully submits that Figures 2-6 and page 3 of specification of the present application are merely the building block of xBOT structure, they neither disclose an at least DSP that applies LESS or a DSP that applies LESS to adaptive filtering of adaptation observations for communication and control signals as responded by the applicant. The examiner respectfully requests the

applicant clearly and specifically point out, within the original specification, the support the above limitations. DSP can be either software base or hardware base wherein the AAPA does not exclude the DSP as either software base or hardware base. Thus, AAPA reasonably discloses the DSP for processing the communication signals wherein whichever processes the communication signals is considered as DSP. In addition, the DSP is well-known in the art as either software base or hardware base for processing data or signals. Martin does not disclose the effectively enlarges the real number matrix to twice its size and not generating two real number matrices as alleged by the applicant but rather Martin disclose a transformation of a complex matrix into two real matrices as cited by the claim wherein the two real matrices are formed as single large matrix similar to G matrix such that $T(A_{mxm}) = R_{mx2m} = [R^1_{mxm} \mid R^2_{mxm}]$.

- c. The applicant argues in pages 20-23 for claims that that Martin does not disclose the limitations of “transforming said adaptation observations from a complex arithmetic to two corresponding sets of real number arithmetic observations by means of BOT” as cited in the claim wherein Martin only discloses the feature of doubling the size of the original matrix.

The examiner respectfully submits that the claims do not specific or detail of transformation but merely discloses a transformation of complex set to two real sets which is clearly seen in Martin wherein Martin disclose a transformation of a complex matrix into two real matrices as cited by the claim wherein the two real

matrices are formed as single large matrix similar to G matrix such that $T(A_{mxm}) = R_{mx2m} = [R^1_{mxm} | R^2_{mxm}]$.

d. The applicant argues in pages 23-26 for claims that the AAPA only discloses the LESS is applied to complex-valued elements instead of real-valued elements and Martin does not disclose the backward transforming using IBOT since Martin discloses $T(*)$ as one to one corresponding (instead of one to two). Therefore, the Martin's invertible transformation is still a one to one correspondence (instead of a two-to-one correspondence).

The examiner respectfully submits that individual reference does not disclose the complete claimed invention but rather the combination of references by Martin and AAPA discloses the claimed invention wherein Martin transforms the complex set numbers into two real set numbers before entering the LESS of AAPA. Nothing in the AAPA or the remark of the applicant indicates that the LESS by AAPA cannot process the real sets number. Thus, it is mathematically very obvious and reasonable to combine the references to form the claimed invention as above. Further as mentioned before, Martin discloses the forward transformation $T(*)$ transform the complex set to two real sets which is clearly seen in Martin wherein Martin disclose a transformation of a complex matrix into two real matrices as cited by the claim wherein the two real matrices are formed as single large matrix similar to G matrix such that $T(A_{mxm}) = R_{mx2m} = [R^1_{mxm} |$

R^2_{mxm}]. Thus, the invertible transformation $T^{-1}(\cdot)$ transform the two real sets back to complex set as $T^{-1}(R_{mx2m}) = T^{-1}\{[R^1_{mxm} | R^2_{mxm}]\} = A^*_{mxm}$.

- e. The applicant argues in page 27 for claims that the AAPA discloses a single input of complex-valued vector input in series instead of the two real number LESS are applied in series as cited in the claimed invention.

The examiner respectfully submits that individual reference does not disclose the complete claimed invention but rather the combination of references by Martin and AAPA discloses the claimed invention wherein Martin transforms the complex set numbers into two real set numbers and AAPA discloses a series manner processing of the LESS. Thus, it is obvious when combining the references, the combination would show or disclose the series manner processing of the LESS with two real set numbers sequentially.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHAT C. DO whose telephone number is (571)272-3721. The examiner can normally be reached on Tue-Fri 9:00AM to 7:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lewis Bullock can be reached on (571) 272-3759. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Chat C. Do/
Primary Examiner, Art Unit 2193

October 26, 2009